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VANET BASED AIRPORT PARKING SYSTEM SIMULATION USING MATLAB

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Abstract— Main objective is building an efficient parking assistant system in the airport by using VANET based wireless network. A vehicular ad hoc network (VANET) uses cars as mobile nodes in a MANET to create a mobile network.[1] A VANET turns every participating car into a wireless router or node, allowing cars approximately 100 to 300 meters of each other to connect and, in turn, create a network with a wide range. As cars fall out of the signal range and drop out of the network, other cars can join in, connecting vehicles to one another so that a mobile Internet is created. It is estimated that the first systems that will integrate this technology are police and fire vehicles to communicate with each other for safety purposes. Automotive companies like General Motors, Toyota, Nissan, DaimlerChrysler, BMW and Ford promote this term. In the airport major problem is the parking assistant, for this we proposed a VANET based assistant system which involves node placement and wireless connectivity for Wi-Fi access and In-Vehicle communication for source to destination path predictions are involved. There exist a few simulators like Sumo Simulator which can be used for VANETs but given the popularity and well spread knowledge of MATLAB tool, a simulation environment in MATLAB could be very useful to many researchers. Such environment can be used while designing better MAC protocols, broadcasting schemes, security features in VANETs. Goal of this project is to create a simulation of Vehicular Ad-Hoc network for different airport scenarios which can be used for testing purposes.

Keywords— VANET, Routing, MAC protocol, RSU.

I. INTRODUCTION

A Vehicular Ad-Hoc Network or VANET is a technology that uses moving vehicles as nodes in a network to create a mobile network. VANET turns every participating vehicle into wireless router or node, allowing vehicles approximately 100 to 300 meters of each other to connect and create a network with wide range. Fig. 1 shows a view of Vehicular Ad Hoc Network. As vehicles fall out of the signal range and drop out of the network, others vehicles can join in, connecting vehicles to one another so that a mobile Internet is created. It is estimated that the first systems that will integrate this technology are police and fire vehicles to communicate with each other for safety purposes [1]. VANET deploy the concept of continuously varying vehicular motion.

VANET communication is normally accomplished through special electronic devices placed inside each vehicle so that an ad hoc network of the vehicles is formed on the road. A vehicle equipped with a VANET device should be able to receive and relay messages to other VANET device equipped vehicles in its neighbourhood. VANET applications can be broadly classified into two categories: safety applications and comfort applications [2].

Fig 1: Vehicular Ad Hoc NetworkModel

An example of a safety application is on-board active safety systems to assist drivers with information (like accidents, road surface conditions, intersections, highway entries) about the road ahead.

Comfort applications are those applications that can provide noncritical services like weather information, gas station or restaurant locations, mobile e-commerce, Internet access, music downloads. In this paper we proposed a simulation of Vehicular Ad-Hoc network for different airport scenario by using MATLAB.

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II. ROUTING PROTOCOLS

There are many routing protocols that have been proposed and estimate to improve the efficiency of VANET.

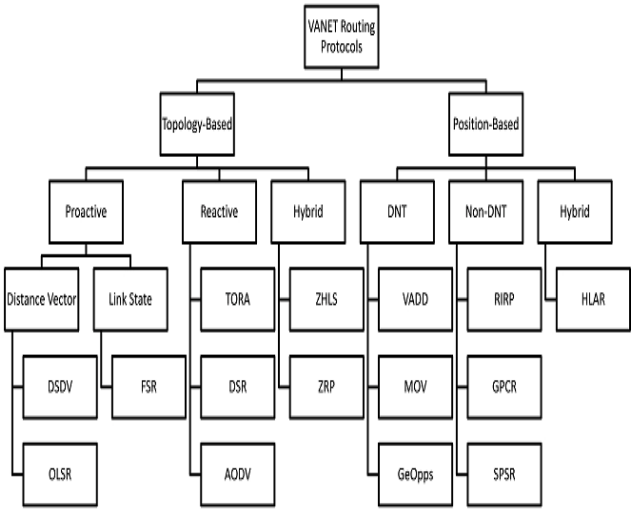

Fig 2 : Vehicular Ad Hoc Network Protocols

A routing protocol generally decides the way of exchanging information in two communication entities. It includes the procedure in establishing a route, forwarding decision and maintaining or recovering from routing failure. The main task for routing protocol is to provide optimal paths between network nodes via minimum overhead.

High mobility of nodes in VANET system make design a routing protocol challenging issue and also responsible to ad hoc routing protocol generally decides the way of exchanging information in two communication entities. It includes the procedure in establishing a route, forwarding decision and maintaining or recovering from routing failure. The main task for routing protocol is to provide optimal paths between network nodes via minimum overhead.

High mobility of nodes in VANET system make design a routing protocol challenging issue and also responsible to compute and maintain efficiently routing paths among the vehicles. So far several routing protocols have been developed, adapted and improved from algorithms that proposed in the past of MANET. But for VANET scenario they are not able to guarantee the same level of efficiency yet. These can be classified in many ways, according to different aspects, such as: protocols characteristics, routing information, techniques used, quality of service, routing algorithms, network structures, and so on [3].

Topology-based routing protocol usually a traditional MANET routing protocol, it uses link's information which stored in the routing table as a basis to forward packets from source node to destination node whereas geographic routing uses the destination node location to forward the packet. Topology-based routing protocols can be classified as proactive (periodic), reactive (on-demand) and hybrid. Proactive protocols allows a network node to use the routing table to store routes information for all other nodes, each entry in the table contains the next hop node used in the path to the destination, regardless of whether the route is actually needed or not. The table must be updated frequently to indicate the network topology changes, and should be broadcast periodically to the neighbors. This scheme may cause more overhead especially in the high mobility network.

However, routes to destination will always be available when needed [4]. Whenever reactive routing protocols (also called on-demand) reduce the network overhead; by maintaining routes only when needed, that the source node starts a route discovery process, if it needs a non-existing route to a destination. Reactive routing protocols are applicable to the large size of mobile ad hoc networks which are highly mobility and frequently topology changes. Stationary RSU (Road Side Unit) which will act as hub or central controller for the given region. This also marks the second type of inter-connection in the VANET system which is Vehicle-to-Infrastructure unit.

III. SIMULATION MODEL

The current simulation is carried out using MATLAB. MATLAB is a high-level language and interactive environment for numerical computation, visualization, and programming. Using MATLAB, you can analyze data, develop algorithms, and create models and applications. The language, tools, and built-in math functions enable you to explore multiple approaches and reach a solution faster than with spreadsheets or traditional programming languages, such as C/C++ or Java.

MATLAB functioning based on operators, in this model various operators have been used to implement the different airport scenario in VANET.

- The “linspace” function generates linearly spaced vectors. It is similar to the colon operator ":" but gives direct control over the number of points and always includes the endpoints.

- The “set” function set (H,' Property Name', Property Value,.) Sets the named properties to the specified values on the object(s) identified by H. H can be a vector of handles, in which case set sets the properties' values for all the objects. If H is empty

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(that is, []), set does nothing, but does not return an error or warning.

- Y = floor(X) rounds each element of X to the nearest integer less than or equal to that element.

IV. EXPERIMENTAL RESULTS

For the typical airport scenario an International airport Google map have been taken and the MATLAB model is proposed as,

Fig 3 : Airport Route Map with Parking Lot

Fig 3 shows the airport scenario where the VANET model is tends to proposed. It consists of a parking lot MATLAB simulation is designed to find the route in order to park the car. Here all routes are considered as nodes and the wireless communication links are also considered as nodes.

Nodes in the blue colour represent the route map with source and destination and the yellow dots interlink the map of source to destination. The red node indicates the RSU1 first communication link for VANET and the green node indicates the second link. The blue line dragging with green shades represents the communication link of first red node with the vehicle.

Fig 4 shows the car parking VANET with red node RSU1 communication link. Maximum of 20 nodes are used in this model.

Fig 5 shows the car parking VANET with green node RSU2 communication link. Once the communication link of RSU1 got terminated communication link of RSU2 gets activated to reach the destination of the vehicle.

Fig 6 shows the car parking VANET with out of RSU range but the RSU1 and RSU2 link can be demonstrated. For the out of range an additional RSU unit is needed.

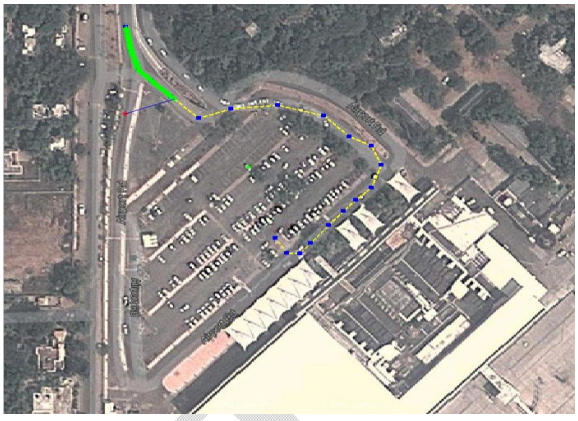

Fig 4 : VANET node with RSU1 link.

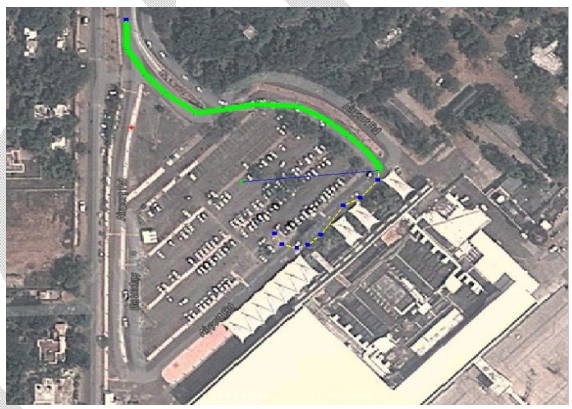

Fig 5 : VANET node with RSU2 link.

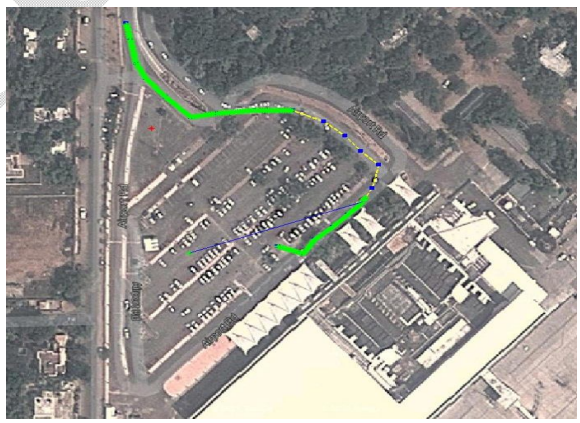

Fig 6 : VANET node with out of RSU link.

V. CONCLUSION AND FUTURE WORK

Airport scenario of VANET is implemented. The simulative models developed are based on the manual node placement. These results can be used as basis for the further routing protocol implementation for automatic path detection methods.

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